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JUN 9 1975

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Estimating Breast Height Diameters from Stump Diameters for Black Hills Ponderosa Pine

James L. Van Deusen¹

Presents tables and equations to estimate diameter at breast height, outside bark, from inside and outside bark diameter of stumps 6 inches and 1 foot high.

Keywords: Diameter estimation, *Pinus ponderosa*.

Ponderosa pine stumps 6 to 12 inches high are commonly left in the Black Hills after roundwood and sawtimber harvests. Breast-height diameters (d.b.h.) of these harvested pines can be estimated from their stump diameters. Four sets of tables and equations are presented to estimate d.b.h.; each set applies to a different combination of stump height and diameter measurements.

If volumes of missing trees should be needed, one can first estimate outside-bark d.b.h. from stump diameter; second, estimate heights of missing trees by determining the relationship between tree height and diameter for trees remaining in the immediate vicinity. The estimated diameters and heights then may be used with locally applicable tables or equations to estimate tree volumes.



Foresters often need to know the sizes of trees removed from cutover stands. If such measurements are lacking, key dimensions of missing trees can be estimated, using aids described in this Note.

¹Associate Silviculturist located at Station's Research Work Unit at Rapid City, South Dakota, in cooperation with South Dakota School of Mines and Technology; Station's central headquarters is maintained at Fort Collins, in cooperation with Colorado State University.

The following tables were developed from diameters and stump height measurements of ponderosa pines throughout the Black Hills and Bear Lodge Mountains. Bark thickness of standing trees was the sum of two bark gage measurements, uphill and downhill side, at each stump height.

Example:

Assume a 6-inch-high stump has a diameter of 10.6 inches outside bark. In table 3, read across in the 10-inch diameter class, down in the .6 column, to intersect at d.b.h. of 8.5 inches.

Table 1.--Tree d.b.h. (diameter at breast height), outside bark, from diameter inside bark at the top of a stump 6 inches high on the uphill side, Black Hills ponderosa pine

Diameter class (Inches)	Stump diameter (i.b.) at 6 inches above ground					Sample trees
	0.0	0.2	0.4	0.6	0.8	
<i>- - d.b.h. in inches - -</i>						
4	4.2	4.4	4.5	4.7	4.9	2
5	5.1	5.3	5.5	5.7	5.8	20
6	6.0	6.2	6.4	6.6	6.8	12
7	6.9	7.1	7.3	7.5	7.7	22
8	7.9	8.1	8.2	8.4	8.6	15
9	8.8	9.0	9.2	9.3	9.5	13
10	9.7	9.9	10.1	10.3	10.5	14
11	10.6	10.8	11.0	11.2	11.4	25
12	11.6	11.7	11.9	12.1	12.3	23
13	12.5	12.7	12.9	13.0	13.2	14
14	13.4	13.6	13.8	14.0	14.2	22
15	14.3	14.5	14.7	14.9	15.1	14
16	15.3	15.4	15.6	15.8	16.0	4
Total trees						200

Table derived from: $d.b.h. = 0.4766 + 0.9240X$
Correlation coefficient: $r = 0.985$
Standard error of estimate: ± 0.53 inch

Table 2.--Tree d.b.h. (diameter at breast height), outside bark, from diameter inside bark at the top of a stump 1 foot high on the uphill side, Black Hills ponderosa pine

Diameter class (Inches)	Stump diameter (i.b.) at 12 inches above ground					Sample trees
	0.0	0.2	0.4	0.6	0.8	
- - <i>d.b.h. in inches</i> - -						<i>No.</i>
4	4.5	4.7	4.9	5.1	5.2	5
5	5.4	5.6	5.8	6.0	6.2	19
6	6.4	6.5	6.7	6.9	7.1	22
7	7.3	7.5	7.7	7.8	8.0	16
8	8.2	8.4	8.6	8.8	9.0	14
9	9.1	9.3	9.5	9.7	9.9	24
10	10.1	10.3	10.4	10.6	10.8	24
11	11.0	11.2	11.4	11.6	11.7	46
12	11.9	12.1	12.3	12.5	12.7	27
13	12.8	13.0	13.2	13.4	13.6	37
14	13.8	14.0	14.1	14.3	14.5	35
15	14.7	14.9	15.1	15.3	15.4	21
16	15.6	15.8	16.0	16.2	16.4	24
17	16.6	16.7	16.9	17.1	17.3	17
18	17.5	17.7	17.9	18.0	18.2	23
19	18.4	18.6	18.8	19.0	19.2	11
20	19.3	19.5	19.7	19.9	20.1	11
21	20.3	20.4	20.6	20.8	21.0	16
22	21.2	21.4	21.6	21.7	21.9	14
23	22.1	22.3	22.5	22.7	22.9	10
24	23.0	23.2	23.4	23.6	23.8	11
25	24.0	24.2	24.3	24.5	24.7	15
26	24.9	25.1	25.3	25.5	25.6	12
27	25.8	26.0	26.2	26.4	26.6	13
28	26.7	26.9	27.1	27.3	27.5	6
29	27.7	27.9	28.0	28.2	28.4	4
30	28.6	28.8	29.0	29.2	29.3	11
31	29.5	29.7	29.9	30.1	30.3	5
32	30.5	30.6	30.8	31.0	31.2	6
33	31.4	31.6	31.8	31.9	32.1	2
34	32.3	32.5	32.7	32.9	33.1	0
35	33.2	33.4	33.6	33.8	34.0	1
36	34.2	34.3	34.5	34.7	34.9	1
Total trees						503

Table derived from: $d.b.h. = 0.8018 + 0.9267X$
Correlation coefficient: $r = 0.992$
Standard error of estimate: ± 0.85 inch

Table 3.--Tree d.b.h. (diameter at breast height), outside bark, from diameter outside bark at the top of a stump 6 inches high on the uphill side, Black Hills ponderosa pine

Diameter class (Inches)	Stump diameter (o.b.) at 6 inches above ground					Sample trees
	0.0	0.2	0.4	0.6	0.8	
<i>- - d.b.h. in inches - -</i>						<i>No.</i>
6	4.6	4.8	5.0	5.1	5.3	9
7	5.5	5.6	5.8	6.0	6.1	5
8	6.3	6.5	6.6	6.8	7.0	14
9	7.1	7.3	7.5	7.6	7.8	8
10	8.0	8.1	8.3	8.5	8.6	5
11	8.8	9.0	9.1	9.3	9.5	13
12	9.6	9.8	10.0	10.1	10.3	9
13	10.5	10.6	10.8	11.0	11.1	7
14	11.3	11.5	11.6	11.8	12.0	15
15	12.1	12.3	12.5	12.6	12.8	9
16	13.0	13.1	13.3	13.5	13.6	5
17	13.8	14.0	14.2	14.3	14.5	8
18	14.7	14.8	15.0	15.2	15.3	6
19	15.5	15.7	15.8	16.0	16.2	0
Total trees						113

Table derived from: d.b.h. = $0.8353X - 0.3838$

Correlation coefficient: $r = 0.988$

Standard error of estimate: ± 0.47 inch

Table 4.--Tree d.b.h. (diameter at breast height), outside bark, from diameter outside bark at the top of a stump 1 foot high on the uphill side, Black Hills ponderosa pine

Diameter class (Inches)	Stump diameter (o.b.) at 12 inches above ground					Sample trees
	0.0	0.2	0.4	0.6	0.8	
<i>- - d.b.h. in inches - -</i>						<i>No.</i>
5	4.0	4.2	4.3	4.5	4.7	21
6	4.9	5.1	5.2	5.4	5.6	17
7	5.8	5.9	6.1	6.3	6.5	21
8	6.7	6.8	7.0	7.2	7.4	12
9	7.5	7.7	7.9	8.1	8.3	22
10	8.4	8.6	8.8	9.0	9.1	30
11	9.3	9.5	9.7	9.9	10.0	44
12	10.2	10.4	10.6	10.7	10.9	38
13	11.1	11.3	11.5	11.6	11.8	40
14	12.0	12.2	12.4	12.5	12.7	31
15	12.9	13.1	13.2	13.4	13.6	33
16	13.8	14.0	14.1	14.3	14.5	10
17	14.7	14.8	15.0	15.2	15.4	24
18	15.6	15.7	15.9	16.1	16.3	16
19	16.4	16.6	16.8	17.0	17.2	16
20	17.3	17.5	17.7	17.9	18.0	11
21	18.2	18.4	18.6	18.8	18.9	14
22	19.1	19.3	19.5	19.6	19.8	18
23	20.0	20.2	20.4	20.5	20.7	11
24	20.9	21.1	21.2	21.4	21.6	14
25	21.8	22.0	22.1	22.3	22.5	16
26	22.7	22.8	23.0	23.2	23.4	9
27	23.6	23.7	23.9	24.1	24.3	7
28	24.4	24.6	24.8	25.0	25.2	10
29	25.3	25.5	25.7	25.9	26.0	6
30	26.2	26.4	26.6	26.8	26.9	4
31	27.1	27.3	27.5	27.6	27.8	5
32	28.0	28.2	28.4	28.5	28.7	0
33	28.9	29.1	29.2	29.4	29.6	1
34	29.8	30.0	30.1	30.3	30.5	1
35	30.7	30.8	31.0	31.2	31.4	1
Total trees						503

Table derived from: d.b.h. = $0.8893X - 0.4556$

Correlation coefficient: $r = 0.994$

Standard error of estimate: ± 0.72 inch

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